

Remarks/Arguments:

The sole remaining independent claims (19 and 29) have been similarly amended. Specifically, each claim further includes the limitation that the electroplating bath further contains brighteners and levelers. Support is found in previous dependent claims 23 and 33, which are amended to now only include carriers as being added to the bath (in addition to the brighteners and levelers, of course). Independent claim 19 and 29 are further amended to define the ratio range of the current densities of the modulated forward and reverse pulses as being from about 1:2.5 to about 1:3.5. Support is found in dependent claims 22 and 32, said claims now amended to further define the respective current densities as being 16 amperes per square foot and negative 48 amperes per square foot. Support is found in the specification at page 9, lines 21 and 22. Support is also seen in FIG. 1.

As defined in the specification, an important feature of the invention is the correct application of current densities for the forward and reverse pulses, in combination with a precisely defined pause following a selected one of said pulses (the reverse pulses in claim 19 and the forward pulses in claim 29). See the end of page 9 and onto page 10, e.g., about 0.5 to about 2.0 mils plating thicknesses in PTH's on boards as thick as about 400 mils. More specifically, the ratio of such pulses is within a relatively precise range (now claimed as about 1:2.5 to about 1:3.5), meaning that the reverse pulses are about 2.5 to about 3.5 times greater current density, for the relatively short (and claimed) pulse durations. Combining these parameters with the specifically defined pause of only about 0.1 millisecond to about 1.0 millisecond assures the unique results defined herein. Finally, another important feature of the invention, as emphasized also in the specification (e.g., page 10, lines 6-8), the bath is able to provide the platings taught herein while using brighteners and levelers. The use of such additional chemical compositions is highly desirable because of the enhanced results using same (brighteners are known to provide a bright, shiny surface on the metal while levelers assist in assuring a smooth deposit which fills in microscopic irregularities in the plating substrate). Significantly, the bath of the invention is able to successfully utilize these without adversely affecting the optimum plating results defined herein (especially the successful uniform plating of thru-holes in relatively thick boards without filling the holes). As defined in the background, this

capability is unique considering the many problems associated with previous efforts, e.g., non-plating of the hole walls at certain depths within the board, plating layers which were too thin, etc. The invention has eliminated these defects in a new and unique manner which can be accomplished without the need for expensive equipment and chemicals.

The invention now claimed is patentably distinguishable over the documents of record in the instant application and particularly the three documents cited in the latest office action. None of these documents, taken singularly or in combination, teach or suggest the now claimed invention. The two rejections under *35 USC 103* as cited in the latest office action are thus deemed overcome and withdrawal thereof is urged.

A careful study of each of the three documents provides support for the above arguments.

U.S. Patent **6,652,727** (hereinafter **Taylor 727**), the primary patent cited by the Examiner as the basis for both rejections under *35 USC 103*, admittedly describes the use of forward and reverse pulse applications, with a pause. However, **Taylor 727** lacks two essential teachings of the now claimed invention as defined in Applicants' independent claims: (1) he fails to teach or suggest reverse pulse current densities much greater than the forward pulse current densities; and (2) he teaches away from using brighteners and levelers by defining a bath "devoid" of such added chemicals. **Taylor 727** instead illustrates the current densities of his reverse pulses as being either significantly less than his forward pulses (his FIG. 1) or substantially the same density as the forward pulses (his FIG. 2). *Nowhere does this patent suggest the unique ratio range taught and claimed by Applicants.* Further, Applicants argue that **Taylor 727** lacks the requisite knowledge to teach such ratios. Instead, he can only state that "experimentation will be required" to discover the best current combinations. See col. 12, line 66 through col. 13, lines 4. He then adds that a skilled practitioner should be able to do so, but Applicants most respectfully argue that if such a practitioner were able to conduct such experiments and do so, why has **Taylor 727** failed to provide at least one mere example? He has not because such experimentation would be extreme and, at a minimum, would require the inventive contributions of one skilled in the art. Applicants have provided these inventive contributions with the invention claimed herein. As also argued, **Taylor 727** describes (and claims – see his claim 1)

his baths as being “devoid of at least one additive selected from the group consisting of levelers and brighteners.” Col. 18, lines 39-42 (claim 1). See also col. 15, lines 35 et. seq. As such, he *teaches away* from using two chemicals Applicants are able to provide in their composition and which are now specifically claimed. The only fair reading one of ordinary skill in the art can make of this document is to eliminate any use of such added chemicals in a bath. Taylor 727 thus inherently fails to teach or suggest the now claimed invention.

Moreover regarding Taylor 727, it must be argued that this patent requires two distinctly different plating steps to allegedly accomplish the required platings. The first is intended to fill “isolated recesses” while the second is then necessary to fill “accessible recesses.” Applicants are not claiming a dual step process with such distinctly different parameters (e.g., the first step requiring reverse pulse current densities much less than the forward pulses, while the second step mandates substantially equal current densities for both pulses). Such added complexities only serve to make the plating operation much more difficult and time-consuming. Applicants’ claimed method eliminates such adversities.

U.S. Patent 6,827,833 (hereinafter Taylor 833) lacks the same two teachings cited above as Taylor 727. Specifically, Taylor 833, including the same named contributor (E. Jennings Taylor) and assigned to the same Assignee as Taylor 727, fails to suggest reverse pulse current densities much greater than the forward pulse current densities, and also describes (and claims – see his claim 1) his baths to be devoid of brighteners and levelers. As such, combining both Taylor patents would fail to suggest the instantly claimed invention because the only fair result of such a combination would be a bath composition lacking in brighteners and levelers and, equally important, reverse pulses of approximately the same current density or less than the forward pulses. As argued above, this would not be a bath and method able to provide the advantages of Applicants now-claimed invention. Withdrawal of the two rejections based on this patent is again respectfully requested.

Martin (U.S. Patent 6,071,398), as stated by the Examiner, relates to a method of electrodepositing metal on a substrate. Combining Martin with the two Taylor patents, however, would fail to suggest the claimed invention as defined by the claims herein for at least two

reasons: (1) the above combination of the two Taylors lacks the requisite suggestion under **35 USC 103**, so it stands that adding the second secondary (and thus third) **Martin** patent will still fail to suggest the invention (that is, adding it cannot render the rejection valid); and (2), even if the combination were possible, the instantly claimed invention could not result. **Martin** fails to mention a pause in his forward and reverse pulse cycles, even requiring that one not be provided by requiring “an uninterrupted, sequential forward to reverse, reverse to forward” process (*emphasis added*). See his claims 1 and 9, lines 3 and 4, respectively. Nowhere does Martin mention a pause for his process, nor is one suggested from his examples. Combining **Martin**, if possible, would thus necessitate a removal of a pause in the Taylor processes, if a fair reading of this document under **35 USC 103** were made. Further, **Martin** does not suggest the 1:2.5 to 1:3.5 forward-reverse pulse current densities uniquely taught by Applicants. Admittedly, **Martin** does describe a process in which forward-reverse current density ratios are utilized, including one in which the ratio is 1:3. However, **Martin** specifically requires that this is only possible while using a process in which different ratios are used in at least three (and four and five from some of the examples cited) different time cycles. That is, **Martin** requires different ratios in different time cycles, not a single ratio for his entire process. See col. 4, lines 49-52, where **Martin** states that during “the electroplating process, the ratio of peak reverse current density to peak forward current density is varied”, and at lines 53-65 where the four ratios are 1:1, 2:1, 3:1 and 1:1. In his “Hull test” example at col. 5, lines 42-51, **Martin** even adds a fifth time period, and a ratio of 1:1. The only fair reading of this patent is to break a plating process into individual time periods and apply different current density ratios over the entire time, perhaps duplicating some from one period to another. The presently claimed invention defines only one ratio range over the entire process, not the need to modify (or repeat) current densities from one time period to another in the same process such that different densities are used before the process is complete. Combining **Martin** with the two Taylor documents would thus inherently fail to suggest the now claimed invention, and withdrawal of the rejection which includes **Martin** as a second secondary document is urged.

In view of the above amending and accompany argumentation, the claims now presented are patentably distinguishable over the documents of record herein, including particularly the three documents cited in the final office action. These documents fail to suggest the claimed

process and the advantageous features cited herein and in the detailed specification. Withdrawal of the rejections and allowance of the claims remaining is most respectfully solicited.

The Application is deemed in condition for allowance, and such action on the part of the Examiner is respectfully urged. Should the Examiner believe, however, that minor differences may remain which, if overcome, will result in allowance of this Application and that said differences may be openly discussed in a telephone conversation, the Examiner is respectfully requested to phone the undersigned to discuss such differences and hopefully resolve same, thereby expediting prosecution of this Application.

Respectfully submitted,



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